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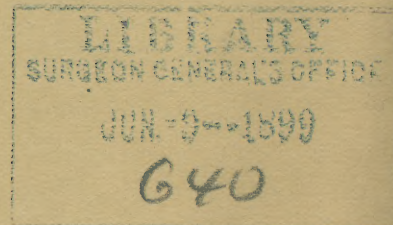
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THE ORIGIN OF THE "TRAUBE" WAVES.

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PENNSYLVANIA.]



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RHYTHMICAL variations of blood pressure not associated with any perceptible alteration in the cardiac or respiratory function have been described by several observers. These waves differ more or less in their form and in the circumstances under which they are found. Traube,¹ who was the first to investigate the subject, mentions two types occurring in dogs in whom the artificial respiration had been suspended; the one is distinguished by a rhythm about that of natural respiration and resembles closely the respiratory variations in blood pressure; the other is much larger and slower. Mayer² observed waves of the latter class in rabbits either breathing naturally or supplied with artificial respiration. They appeared singly, at irregular intervals, or in rhythmical groups. Their cause was not apparent.

Since all forms of these waves are altered in their character in the same manner by similar influences the conclusion seems probable that the same cause underlies them all. When we come to look for this cause we find in the first place that the waves are due to changes in the vasomotor centre. The evidence in support of this is so universally acknowledged that I will mention only the experiment of Mayer, in which the temporary loss of function of the medulla produced by shutting off the blood supply causes the waves to disappear. The question as to what impels the vasomotor centre to send out these rhythmical impulses is not so easily answered. Hering³ suggested that impulses pass over from the respiratory centre (irradiation). He grounds his belief on the correspondence in rate between the Traube waves and the respiration, and on the fact that sometimes in imperfectly curarized animals slight spasmodic movements of the diaphragm indicating activity of the respiratory centre,

¹ TRAUBE: *Centralblatt für die medicinische Wissenschaften*, 1865, p. 881.

² MAYER: *Sitz.-Ber. d. Kaiserl. Akad. d. Wissensch. zu Wien, Math.-nat. Kl.*, 3, 1876, lxxiv, p. 281.

³ HERING: *Ibid.*, 1870, lx, p. 829.

but not strong enough of themselves to have any effect on blood pressure, are seen together with the Traube-Hering waves. The first of these reasons seems hardly applicable at least to the waves described by Traube as recurring at intervals of thirty seconds (Hering himself says the waves recur at the rate of 5 to 15 per minute). Concerning the second argument, slight spasmodic movements may often be observed in the limbs and trunk muscles of imperfectly curarized animals, and Knoll¹ has seen them recur at regular intervals, but they are far too slight to influence the blood pressure.

Mayer supports Hering's theory of irradiation from the respiratory centre on the grounds that any manipulation, as section of the vagi, which lowers the respiratory rate makes the waves more prominent; that stimulation of the central end of a cut vagus alters their type; and that they do not occur after paralysis of the respiratory centre through shutting off the blood supply to the brain. But these reasons are open to objection. Unless the lowering of the rate of breathing is accompanied by a corresponding increase in the depth of each respiratory movement—and the maintenance of the normal respiratory exchange after section of the vagi is doubtful—the accumulation of carbon dioxide should favor the occurrence of these waves; moreover, the vagi are concerned with the innervation of so many functions that to draw any positive conclusions regarding such an obscure subject from the effects of their section is hardly wise. The support drawn from the discovery that stimulation of the central end of the vagus affects the form of the wave, loses much of its weight in view of the fact that Knoll has since found that stimulation of any sensory nerve has the same effect. As to the third reason for his belief, Mayer seems to have forgotten that in occluding the blood supply of the medulla he paralyzed the vasomotor as well as the respiratory centre.

A better method of determining whether the respiratory centre is to be considered as a casual factor in the production of Traube-Hering waves would seem to be the use of some agent which paralyzes the respiratory and not the vasomotor centre. In some experiments with *veratrum viride*² I find that this substance offers us a means of thus separating the two functions. By proper doses (about 0.04 c.c. of the fluid extract per kilo, for dogs) the respiration

¹ KNOLL: *Ibid.*, 1886, xcii, p. 447.

² *Veratrum album* has the same effect.

can be absolutely paralyzed while the rise of pressure brought about by the asphyxia demonstrates that the vasomotor mechanism is still functional. Under these circumstances I have seen the most marked rhythmical variations in the blood pressure, both when it was high (150 mm. Hg) and when it was low, either with artificial respiration or when the animal was asphyxiated. *The occurrence of Traube waves when the respiratory centre is paralyzed shows that the impulses which occasion their discharge do not arise in that centre.*

